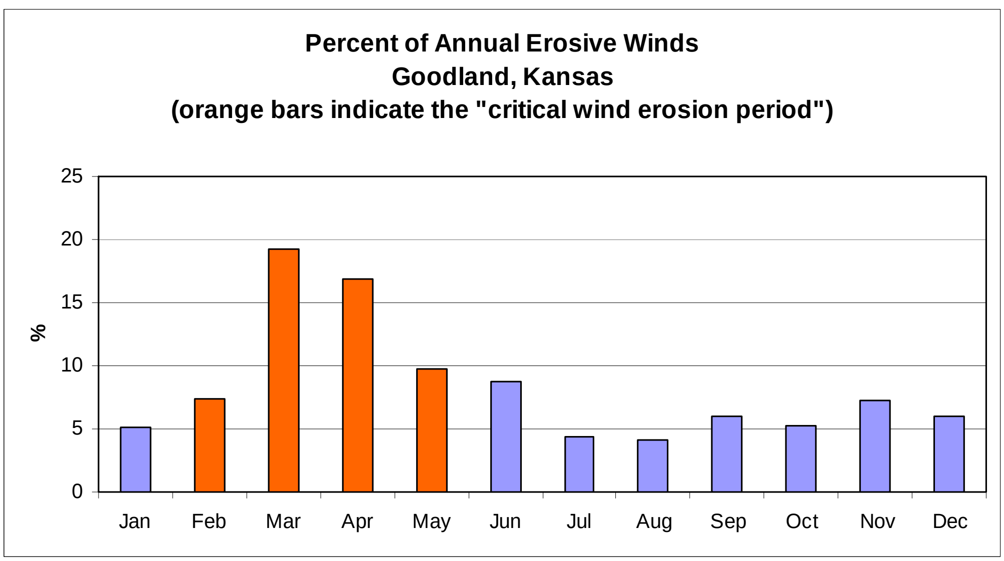
Number 388
February 8, 2013

1. Factors in wind erosion potential on sparsely covered soil

Some wheat stands, especially in parts of western Kansas, are thin or poorly developed this year due to dry conditions. This increases the potential for wind erosion during the winter and early spring months, when wind erosion rates are often at their highest.



Source: John Tatarko, USDA-ARS Engineering and Wind Erosion Research Unit, Manhattan, Kansas

When vegetation is insufficient, ridges and large soil clods (or aggregates) are frequently the only means of controlling erosion on large areas. Roughening the land surface with ridges and clods reduces the wind velocity and traps drifting soils. A cloddy soil surface will absorb more wind energy than a flat, smooth surface. Better yet, a soil surface that is both ridged and cloddy will absorb even more wind energy and be even more effective in reducing the potential for wind erosion.

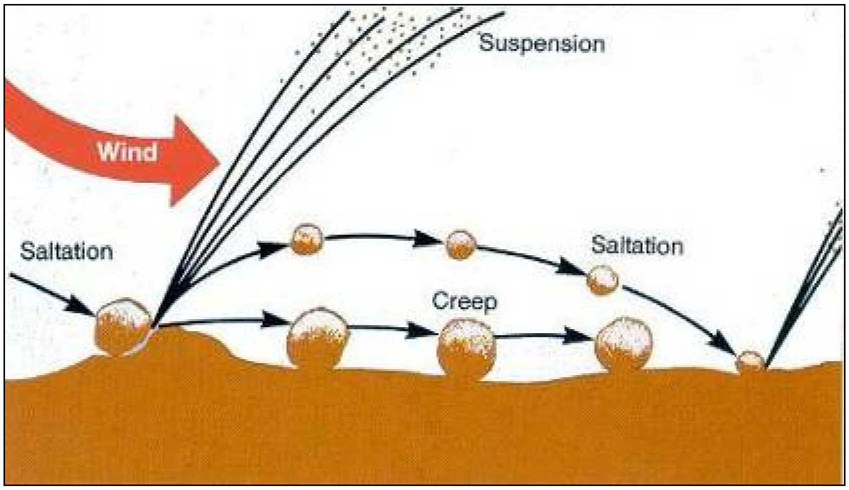
Soil crusts and frozen ground also can increase resistance of the surface soil to wind forces, but this effect is only temporary and should not be relied on for erosion control.

Crosswind ridges

Crosswind ridges are formed by tilling or planting across the prevailing wind erosion direction. If erosive winds show no seasonal or annual prevailing direction, this practice has limited protective value. In Kansas, the prevailing winds in the winter are from the north, and in early spring the prevailing winds are from the south. Crosswind ridges at this time of year, therefore, should be in an east-west direction to protect from both northerly and southerly winds.

Month	Prevailing Wind Erosion Direction, Goodland
January	NNW
February	NNW
March	NNW
April	NNW
May	SSE
June	S
July	SSE
August	SSE
September	S
October	NNW
November	NNW

Tillage implements can form ridges and depressions that alter wind velocity. The depressions also trap saltating soil particles and stop avalanching of eroding material downwind.



However, soil ridges protrude higher into the turbulent wind layer and are subject to greater wind forces. Therefore, it is important that cloddiness on top on the ridge is sufficient to withstand the added wind force, otherwise they will quickly erode, and the beneficial effects will be lost. Ridging sandy soils, for example, is of little value because the ridges of sand are erodible and soon leveled by the wind.

Soil aggregates and "cloddiness"

Clod-forming tillage produces aggregates or clods that are large enough to resist the wind force and trap smaller moving particles. They are also stable enough to resist breakdown by abrasion throughout the wind erosion season.

If clods are large and stable enough, as smaller particles are removed or trapped, the surface becomes stable or "armored" against erosive action. The duration of protection depends on the resistance of the clods to abrasion or changes in the wind direction.

Of the factors that affect the size and stability of soil aggregates, most notable is soil texture. Sandy or coarse-textured soils lack sufficient amounts of silt and clay to bind particles together to form aggregates. Such soils form a single-grain structure or weakly cemented clods, a condition that is quite susceptible to erosion by wind. Loams, silt loams, and clay loams tend to consolidate and form stable aggregates that are more resistant to erosive winds. Clays and silty clays are subject to fine granulation and more subject to erosion.

Many other factors also affect aggregate consolidation and stability — climate, including moisture; compaction; organic matter; lime; microorganism activity; and other cementing materials.

Any process that reduces soil consolidation also increases erodibility. The persistence of aggregates is greatly affected by the climatic process of wetting and drying, freezing and thawing, or freeze-drying, which generally disintegrates clods and increases erodibility.

Mechanical action, such as tillage, animal or machine traffic, and abrasion by saltating soil particles also can affect cloddiness. Tillage may either increase or decrease clods at the surface, depending on the soil condition in the tilled layer and the type and speed of the implement. Repeated tillage usually pulverizes and smooths dry soils and increases their erodibility, especially if done with implements that have an intensive mechanical action, such as tandem disks, offset disks, or harrows.

Soil water at the time of tillage also has a decided effect on cloddiness. Research has found that different soils have differing water contents at which soil pulverization is most severe. If the soil is extremely dry or extremely moist, smaller clods are produced than at intermediate water contents.

-- John Tatarko, Soil Scientist, USDA-ARS
tatarko@ksu.edu

-- DeAnn Presley, Soil Management Specialist
deann@ksu.edu

2. Emergency measures to control wind erosion

Cropland can be quite susceptible to wind erosion under some conditions. A particularly serious hazard is created when crop residues are burned or removed for forage. Winter wheat and other fall-planted crop fields may also be susceptible during periods of low cover in the winter and early spring.

This is particularly true after a drought year or after other crop failures, and this is the case in many areas of Kansas this year. Marginally productive cropland may not produce sufficient residue to protect against wind erosion. In addition, overgrazed or poorly vegetated rangeland may also subject to wind erosion.

Field in southwest Kansas with major wind erosion damage. Photo by DeAnn Presley, K-State Research and Extension.

It is important to monitor field conditions and identify fields that are in a condition to blow. Such conditions include low vegetation cover and a high proportion of erodible-sized clods (less than 1 mm in size, or about the thickness of a dime). It is better to be proactive and treat potential problems before they occur than to try to react and catch up once a field is actively eroding. Once soil movement has started, it is difficult to completely stop further damage. However, prompt action may prevent a small erodible spot from damaging an entire field or adjacent fields.

Emergency Control Measures

**** Mulching.*** If wind erosion has already started, it can be reduced by mulching with manure or other anchored plant materials such as straw or hay. To be effective, at least 1.5 to 2 tons per acre of straw or grass or 3 to 4 tons per acre of corn or sorghum stover are needed to control areas of erosion, and the straw or hay must be anchored. Residue can be spread by hand, spreader or other mechanical equipment.

A stubble puncher or disk set straight may be used to anchor residue and prevent it from being blown away. Wet manure application should be 15 to 20 tons/acre and not incorporated into the soil. Care should be taken to not add wheel paths parallel to the wind direction as the mulch is applied. Traffic areas and wheel paths can contribute to wind erosion.

Generally, mulches are practical only for small areas, so mulching is most effective when applied before the soil starts to move. Producers should scout fields to identify areas that might be susceptible to wind erosion (low vegetation cover and a high proportion of erodible-sized clods less than the thickness of a dime) if they plan to use mulch or manure to controls.

**** Emergency Tillage.*** Emergency tillage is a last-resort method that can be effective if done promptly and with the right equipment. The goal of emergency tillage is to make the soil surface rougher by producing resistant clods and surface ridges. A rough surface reduces wind speed. The larger clods and ridges resist movement and provide traps to catch the moving soil particles.

Chisels with single or only a few tool ranks are frequently used to roughen the soil surface. The combination of chisel point size, speed, and depth that produces the roughest surface with the most firm, resistant clods should be used for emergency tillage.

Research has shown that a narrow chisel (2 inches wide) on 24- to 54-inch spacing, operated 3 to 6 inches deep will usually bring enough resistant clods to the surface to control erosion on fine-textured (clay-based) soils. A medium shovel (4 inches wide) can be effective for medium-textured soils (loamy soils). Spacings should typically be narrower where there is no cover and wider in areas of partial cover, such as a growing crop or plant residue.

If the erosion conditions recur or persist, a second, deeper chiseling should split the first spacing. Tillage passes should be made perpendicular to the direction of the prevailing wind causing the erosion.

Emergency tillage across 50 percent of the field. Photo courtesy of USDA-ARS Engineering and Wind Erosion Unit, Manhattan, Kansas.

Widely spaced shanks used for emergency tillage, making clods to roughen the soil surface. Photo courtesy of University of Nebraska.

If emergency tillage is to be used in growing crops that are covered by crop insurance, producers should check with their crop insurance providers regarding emergency tillage insurance rules. Emergency tillage does not significantly reduce wheat yields of an established crop. Studies in southwest Kansas and Manhattan demonstrate that the use of a chisel on 40-inch spacing reduced wheat yields by 5.5 bushels per acre on the emergency tillage area, due to direct injury caused by the tillage action. Since the entire field is rarely tilled when performing emergency tillage, the overall yield reduction for the field will be less than 5.5 bushels per acre. In fact, yields in the untilled portion of the field actually can be increased by the use of emergency tillage since that tillage will reduce the amount of damage to wheat caused by wind erosion. The overall reduction in yield for fields that have received emergency tillage has been as little as 1 bushel per acre in the studies mentioned above.

Performing emergency, clod-forming tillage across the field is effective in reducing wind erosion. The degree of success of emergency tillage is highly dependent on climatic, soil, and cover condition. It is often not necessary to till the entire field, but rather, it is very effective to perform emergency tillage passes across 50% of the field (till a pass, leave a pass, repeat). Narrow chisel spacing (20 to 24 inches) is best for this method.

If 50% of the area has been tilled and wind erosion persists, the omitted strips can be emergency-tilled in a second operation to make result in full-cover tillage. If a second tillage pass is needed, it should be at a greater depth than the first pass. Wide chisel spacings are used in the full-field coverage method. The space between chisel grooves can be chiseled later should wind erosion persist.

All tillage operations should be perpendicular or across the direction of the prevailing or eroding wind. For most of Kansas, this means that an east-west direction of tillage is likely best.

The best wind erosion control is created with maximum surface roughness when resistant clods cover a major portion of the surface. Research shows that lower travel speeds of 2 to 3 mph generally produce the largest and most resistant clods. However, speeds of 5 to 7 mph produce the greatest roughness. Because clod resistance is usually reduced at higher speeds, the effect may not be as long-lasting as at lower speeds. Thus, higher speeds are recommended where erosion is already in progress, while lower speeds might be a better choice in anticipation of erosion.

Depth of tillage usually affects clod stability more than travel speed, but optimum depth is highly dependent on soil conditions (such as moisture level) and compaction. Deeper tillage passes can produce more resistant clods than shallow passes.

If the problem is severe and the wheat has already been destroyed or the ground is bare, chisels 4 to 6 inches wide on a 24- to 30-inch spacing will generally provide enough clods to control erosion. Operating depth should be 4 to 6 inches.

Controlling wind erosion on sandy soils

Loose sandy soils require a different tillage approach to effectively control erosion. Clods cannot be formed at the surface that will be sufficiently resistant to erosion on sandy soils. Erosion resistance is achieve through building ridges and furrows in the field to provide adequate protection.

A 14-inch moldboard lister spaced 40 to 50 inches apart (or an 8-inch lister on 20- to 24-inch spacing) is needed to create sufficient surface roughness. The first listing pass should be shallow, not more than about 4 to 5 inches deep. Then, when additional treatment is needed, the depth should become progressively deeper. Alternatively, for the second treatment the original ridge may be split.

The addition of manure to the ridged surface may also be beneficial in these situations.

Tips for effective emergency tillage

* Watch the weather forecast for periods of high winds, particularly when soils are dry.

* Assess residue and plant cover prior to the wind blowing, and take preventive action with emergency tillage. It is much easier to prevent the problem from starting than to stop erosion after it begins. If you wait, the soil only gets drier and some moisture is needed to form clods.

* Use the combination of tractor speed, tillage depth, and chisel point size that will produce the roughest surface with the most resistant clods. If wind erosion is anticipated, do some test tillage prior to an erosion event to see what tillage tool, depth, and speed will provide adequate clods and surface roughness.

* Always start at the upwind location when the field is blowing. A sufficient area upwind of the eroding spot should be tilled, in addition to the area presently blowing.

* Till in a direction perpendicular to the prevailing wind direction. For row crop areas it may be necessary to compromise direction and follow the row pattern. Maintain as much anchored stubble in the field as possible.

-- DeAnn Presley, Soil Management Specialist
deann@ksu.edu

-- Peter Tomlinson, Environmental Quality Specialist
ptomlin@ksu.edu

3. Estimating crop residue cover

Where wheat has been planted no-till into fields with sufficient levels of crop residue, this residue will reduce wind erosion during the winter and early spring.

How much residue is enough? Do you know how to estimate it? For producers, it is very important to know how to measure crop residues, as this provides an estimate of how well soil is protected from wind and water erosion. To meet the definition of conservation tillage (including no-till, strip-till, ridge-till and mulch-till), at least 30% of the soil surface must be covered with residue after planting.

There are three main methods used to estimate residue, but the most reliable is the line-transect approach. For this method, use either a 100' tape measure or a rope with 100 knots tied at 1' intervals. Stretch the tape or rope at a 45-degree angle to the row direction, walk along the tape, and count the number of times a piece of residue at least 1/8" in diameter occurs under each foot mark or knot.

Tape measure used for the line-transect method. Place tape measure at a 45-degree angle to the rows. Photo by DeAnn Presley, K-State Research and Extension.

Calculate the percent coverage by dividing the number of times that residue occurred by the total number of observations (knots or feet). Note that you could also use a 50' rope with knots at 6" intervals, or a 50' tape and measure every 6". The important thing is to make 100 observations at each site, and repeat this process at five sites per field in order to determine the field average.

The yardstick method is another approach for measuring residue levels in the field. Throw a yardstick, and measure the amount of residue under one side of the yardstick. If 18 inches of the yardstick has residue beneath it, the residue level is 50 percent for that observation method. Just make sure you are randomly sampling! It is best to avoid end-rows in any of the methods for residue estimation.

You can also compare your fields to photos that contain a known percentage of crop residue. The following K-State Research and Extension publications are available with photos:

Soybean and sunflower residue: http://www.ksre.ksu.edu/library/crpsl2/L783.pdf
Grain sorghum residue: http://www.ksre.ksu.edu/library/crpsl2/L782.pdf
Corn residue: http://www.ksre.ksu.edu/library/crpsl2/L784.pdf
Wheat residue: http://www.ksre.ksu.edu/library/crpsl2/L781.pdf

If you estimate residue in the winter, how much will be left in the spring? One estimate is that approximately 10 percent of the residue will blow away or decompose over winter, but residue decomposition varies depending on temperature and moisture (i.e., residue decomposes more quickly in warm, moist climates). If you graze crop residues, some studies suggest that cattle will remove approximately 25% of the material, but that also depends on the location of waterers, mineral tubs, etc., and how long the cattle remain on a particular field.

The critical period for wind erosion in Kansas is November through spring until new vegetation is established.

-- DeAnn Presley, Soil Management Specialist
deann@ksu.edu

4. Test cool-season pastures this spring for pH, P, K, and S

For most producers, fertilizing cool-season grasses such as smooth bromegrass and tall fescue means applying nitrogen in the spring. But there can be more to it than that.

There is a large body of research in Kansas to suggest that phosphorus (P), potassium (K), and sulfur (S) may also give responses at low soil test levels. The key to determining if these nutrients may be needed is a good soil test. Unfortunately, in sampling cool-season pastures and hayfields, the sampling process has gotten a little more complicated in recent years.

Sampling soils of cool-season pastures

Where we used to think of using a single soil sample from the surface 6 inches to make all our fertilizer and lime decisions, we now may need as many as three samples.

First sample. For P and K, a good soil test will still be a 0-6 inch sample, consisting of 10-15 individual cores collected across the field. If soils vary widely, sampling by soil type will improve the quality of the soil testing. Spring is a good time to take those samples, before the grass really takes off and begins to grow.

Second sample. While P and K recommendations are based on a 6-inch sample, a second sample taken from the surface 0-3 inches for pH only will give the best information for making lime recommendations. Brome and fescue are both relatively tolerant of acid soils, and can make good yields at pH as low as 5.5. Where red clover is added to improve forage quality, the clover will yield best and last longer, if pH is increased to 6.2 or higher.

The reason soils become acid is primarily the result of N fertilizer application. Ammonium nitrate or urea will both require about 360 pounds of ECC, or roughly 700 pounds of agricultural lime, to neutralize the acidity produced from every 100 pounds of N applied. Since both of these products are normally broadcast on the soil surface, the acidity will be produced in the surface 2-3 inches of soil, lowering the pH of that surface soil.

We then add lime, which is relatively insoluble in water, to the soil surface to neutralize the acidity. We end up needing to lime more frequently, but at lower rates, just as with no-till fields. By focusing on that surface 3 inches of soil, we can do a better job of determining the pH in the region of the soil where many of roots are and where we add fertilizer and lime. This results in a more accurate lime recommendation.

Third sample. The third sample we may need is a deeper profile sample for S. Research over the past 30 years has shown that both bromegrass and tall fescue have responded to S fertilizer more than any other crops we grow. That situation is changing, as the Clean Air Act has reduced the amount of S deposited on soils dramatically. Today we are also likely to see responses to S on many soils with no-till wheat and corn, too.

We need to consider deeper soil samples for S because it is a mobile nutrient. It is not retained tightly in soils like P or K, but rather tends to move into the subsoil and accumulates on the high-clay subsoil found in many Kansas soils. So just testing the surface soil will many times indicate S is deficient, when actually there may be plenty of S in the subsoil to meet crop needs.

P, K, and S application timing

When is the best time to apply P, K and S? Ideally, late summer or fall is the preferred time to make these applications. Fall applications of P and K are important to stimulate root growth and the production of new buds for next year’s shoots. Fall applications of P when soil test levels are low have consistently shown better responses than spring applications.

Adding S in the fall may also be beneficial. The reason is that most of the S fertilizer available is in elemental S form. Plants can only take up and utilize S in the form of sulfate. Elemental S must be oxidized to sulfate by bacteria in the soil, and that may take several months. By applying the S in late summer or fall, the bacteria will have time to “do their thing” before the plant needs large quantities of S the following spring.

Cool-season grass response to P, K, and S fertilization

Research conducted in eastern Kansas has shown that at low P and S soil test levels, hay yields can be increased 400 to 700 pounds per acre with modest applications. Generally, the most efficient P fertilization will be obtained from the first 30 pounds applied. Only at very low soil test levels do we see responses to higher rates. Sulfur applications are also generally made at modest application rates.

Can you build P and K levels in soils in a bromegrass field? Yes, but it will be very expensive and not very efficient. P and K are both taken up in large quantities in the vegetation of bromegrass. They can be taken up in amounts which exceed the amounts required for optimum growth. This isn’t very significant in grain crops, where the vegetation is returned to the soil and those nutrients are “recycled.” However in forage crops, we harvest the vegetation and remove those excess quantities of nutrients. Thus, trying to build soil test or maintain high soil test levels in forage crops is difficult and not economical.

Summary

Think about soil testing your cool-season grasses this spring for pH, P, K, and S in preparation for fall fertilization. It's a little more difficult than it used to be, but it could pay some big benefits.

-- Dave Mengel, Soil Fertility Specialist
dmengel@ksu.edu

5. North Central Kansas Experiment Fields Winter Update, February 14

The North Central Kansas Experiment Fields Winter Update will be held on Thursday, February 14, from 9:30 a.m. to noon at the Nesika Energy Conference Room, approximately 1.5 miles west and 1 mile south of Scandia.

Topics at the winter update will include:
* Utilizing optical sensors for nitrogen management
* Foliar fungicides on corn with light disease pressure?
* Drought summary and weather outlook
* Irrigation management of drought-tolerant corn hybrids

Lunch will be served at the conclusion of the meeting. For more information, contact Randall Nelson at 785-335-2836 or jrnelson@ksu.edu.

-- Randall Nelson, Agronomist-in-Charge, North Central Kansas Experiment Fields
jrnelson@ksu.edu

6. Comparative Vegetation Condition Report: January 22 – February 4

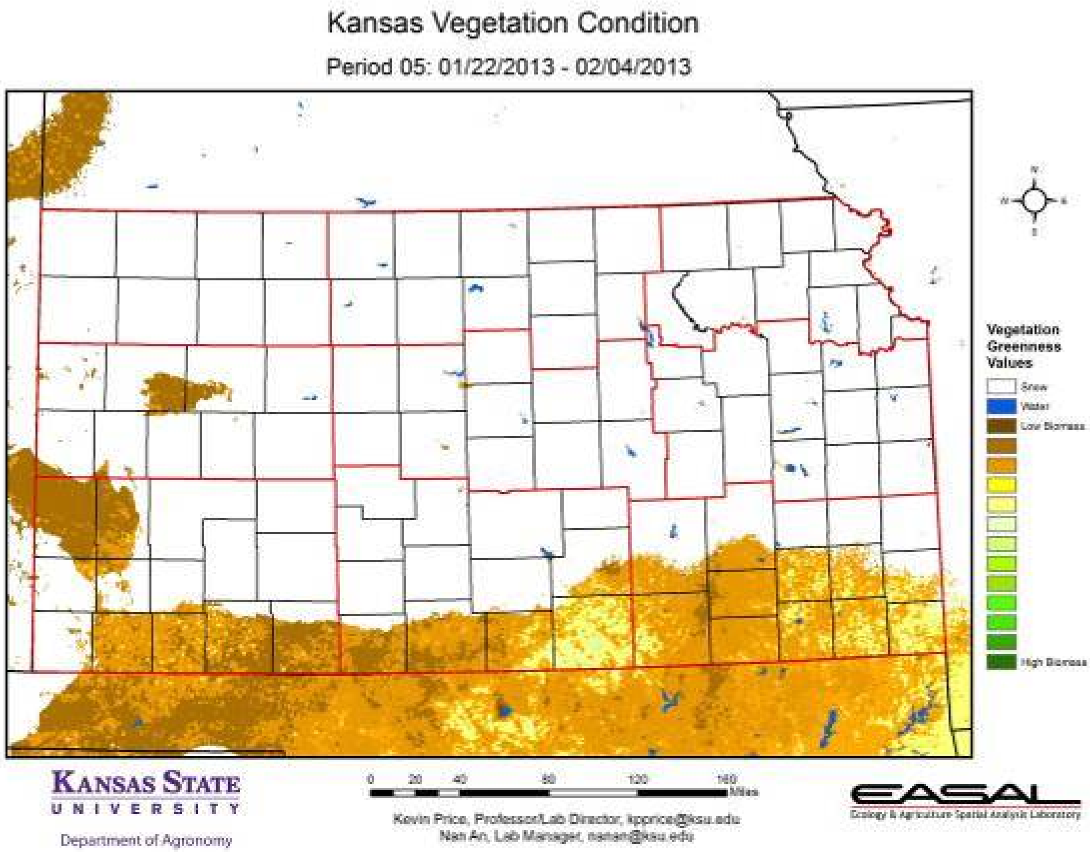
K-State's Ecology and Agriculture Spatial Analysis Laboratory (EASAL) produces weekly Vegetation Condition Report maps. These maps can be a valuable tool for making crop selection and marketing decisions.

Two short videos of Dr. Kevin Price explaining the development of these maps can be viewed on YouTube at:
http://www.youtube.com/watch?v=CRP3Y5NIggw
http://www.youtube.com/watch?v=tUdOK94efxc

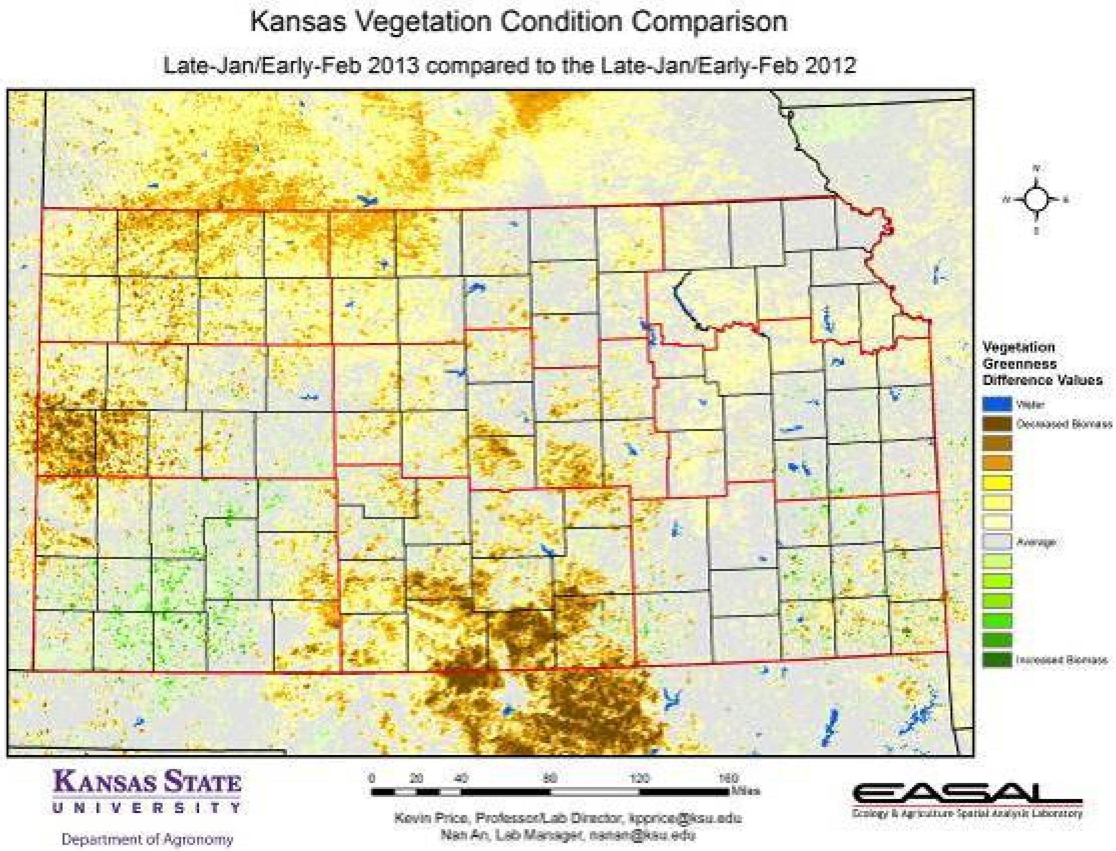
The objective of these reports is to provide users with a means of assessing the relative condition of crops and grassland. The maps can be used to assess current plant growth rates, as well as comparisons to the previous year and relative to the 24-year average. The report is used by individual farmers and ranchers, the commodities market, and political leaders for assessing factors such as production potential and drought impact across their state.

NOTE TO READERS: The maps below represent a subset of the maps available from the EASAL group. If you'd like digital copies of the entire map series please contact Kevin Price at kpprice@ksu.edu and we can place you on our email list to receive the entire dataset each week as they are produced. The maps are normally first available on Wednesday of each week, unless there is a delay in the posting of the data by EROS Data Center where we obtain the raw data used to make the maps. These maps are provided for free as a service of the Department of Agronomy and K-State Research and Extension.

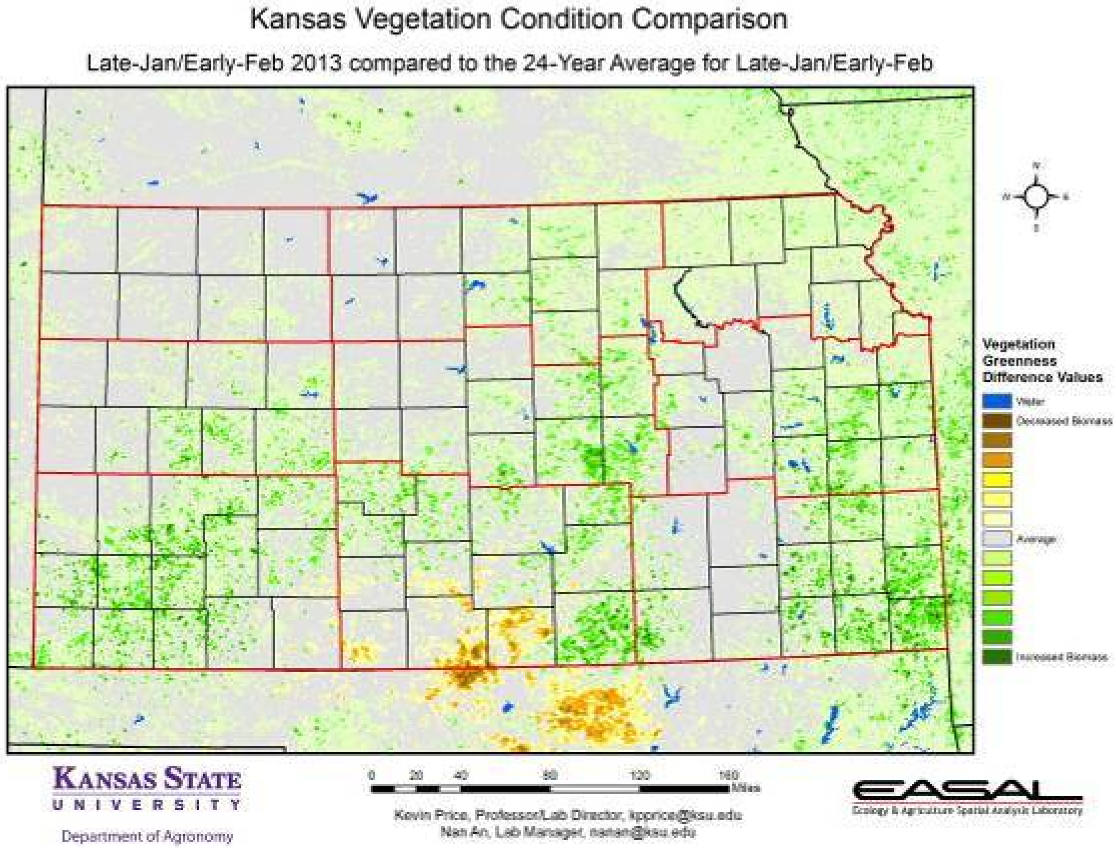
The maps in this issue of the newsletter show the current state of photosynthetic activity in Kansas, the Corn Belt, and the continental U.S, with comments from Mary Knapp, state climatologist:



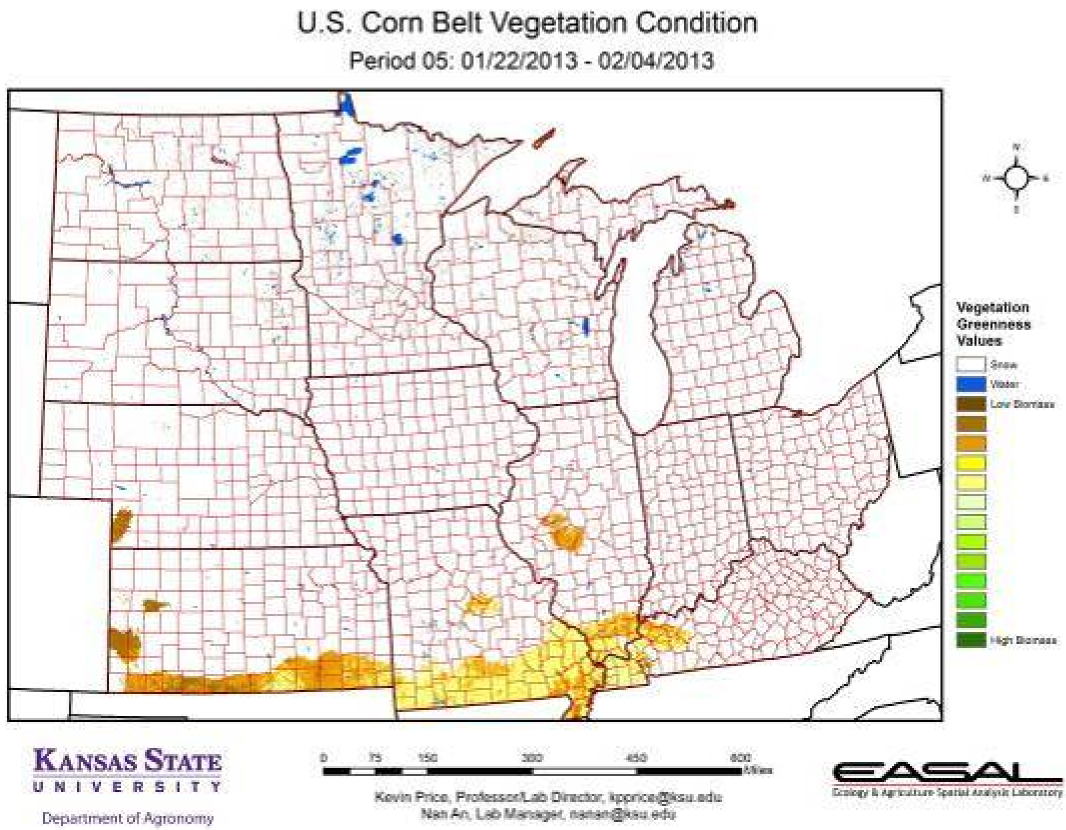
Map 1. The Vegetation Condition Report for Kansas for January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that snowfall was again a feature for all but the southernmost counties. Snowfall amounts were mainly on the light side. The greatest snow depth was 8 to 10 inches in north central Kansas, with 2 to 3 inches in the Hutchinson to McPherson areas.



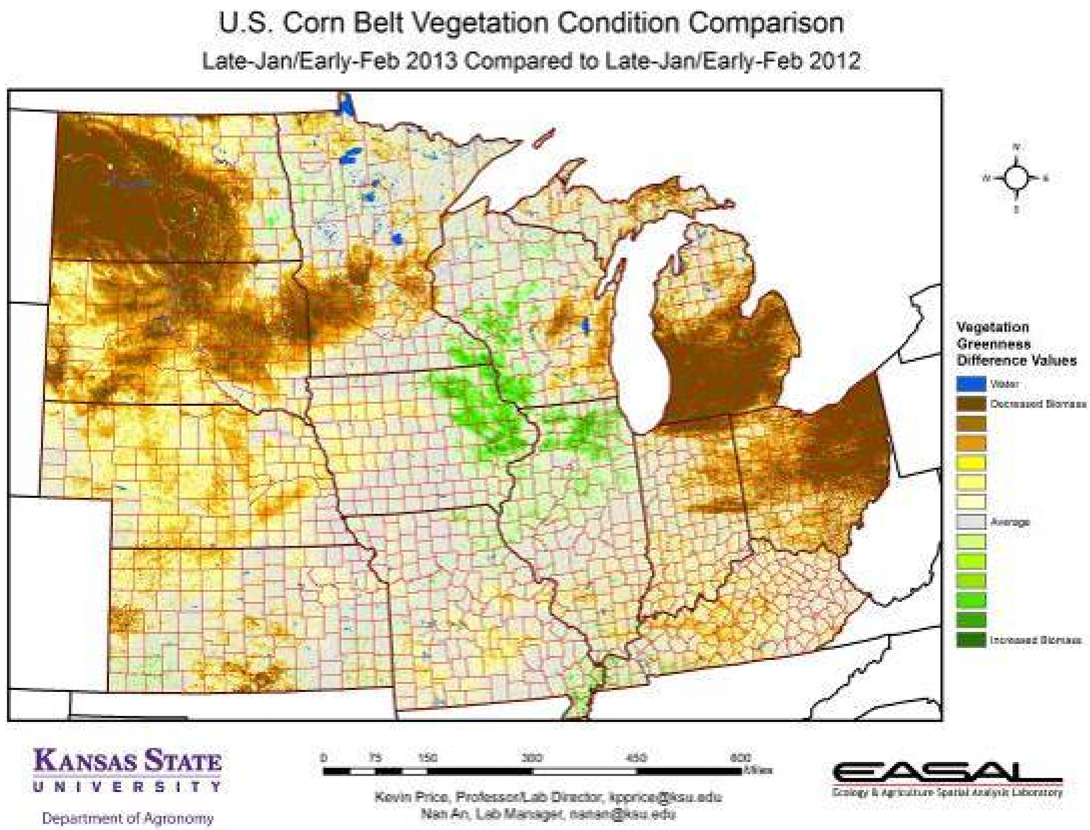
Map 2. Compared to the previous year at this time for Kansas, the current Vegetation Condition Report for September January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that photosynthetic activity has be lower across much of the state. Only parts of southwest Kansas have at, or slightly above, last year's level of activity. This narrow band had more favorable fall moisture and is reported as in the "Severe" rather than "Extreme" or "Exceptional" drought category.



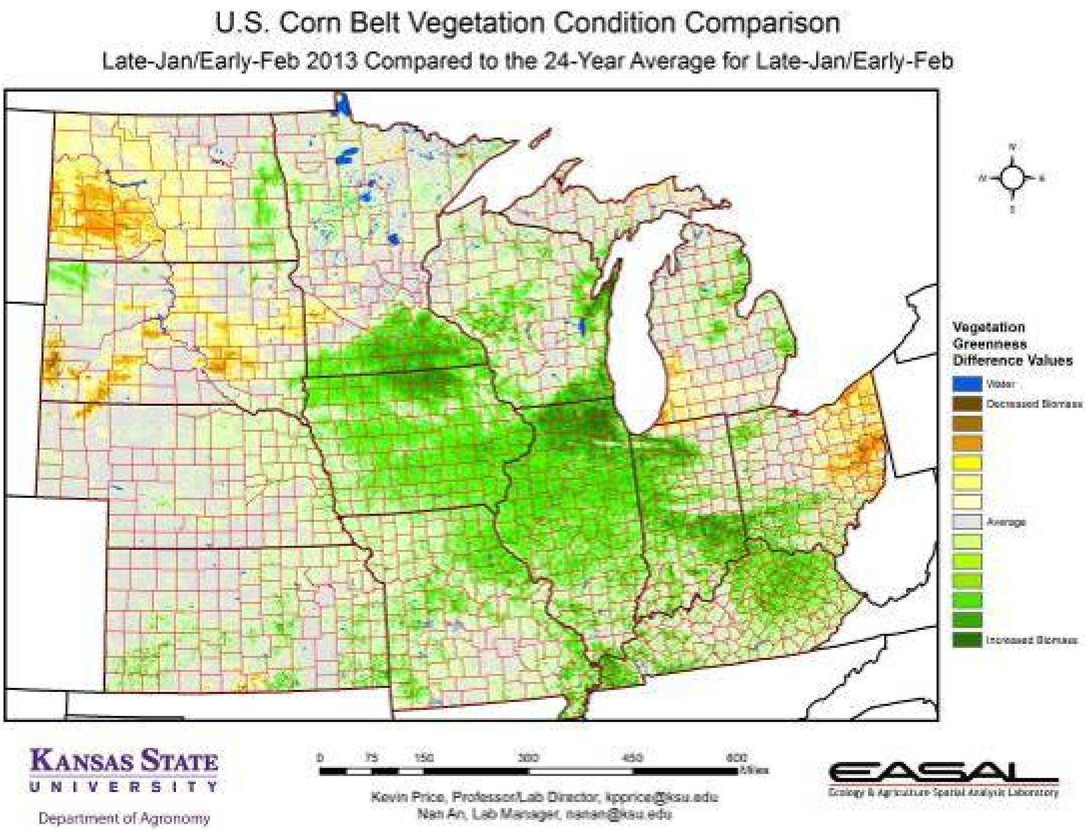
Map 3. Compared to the 24-year average at this time for Kansas, this year's Vegetation Condition Report for January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that much of the state has above-average photosynthetic activity. The exception continues to be in south central Kansas, where Barber and Harper counties have below-average production. The gradient from southwest to northeast Kansas continues to fall along the boundary from cooler-than-average temperatures in the northwest to much-warmer-than-average temperatures in the southeast.



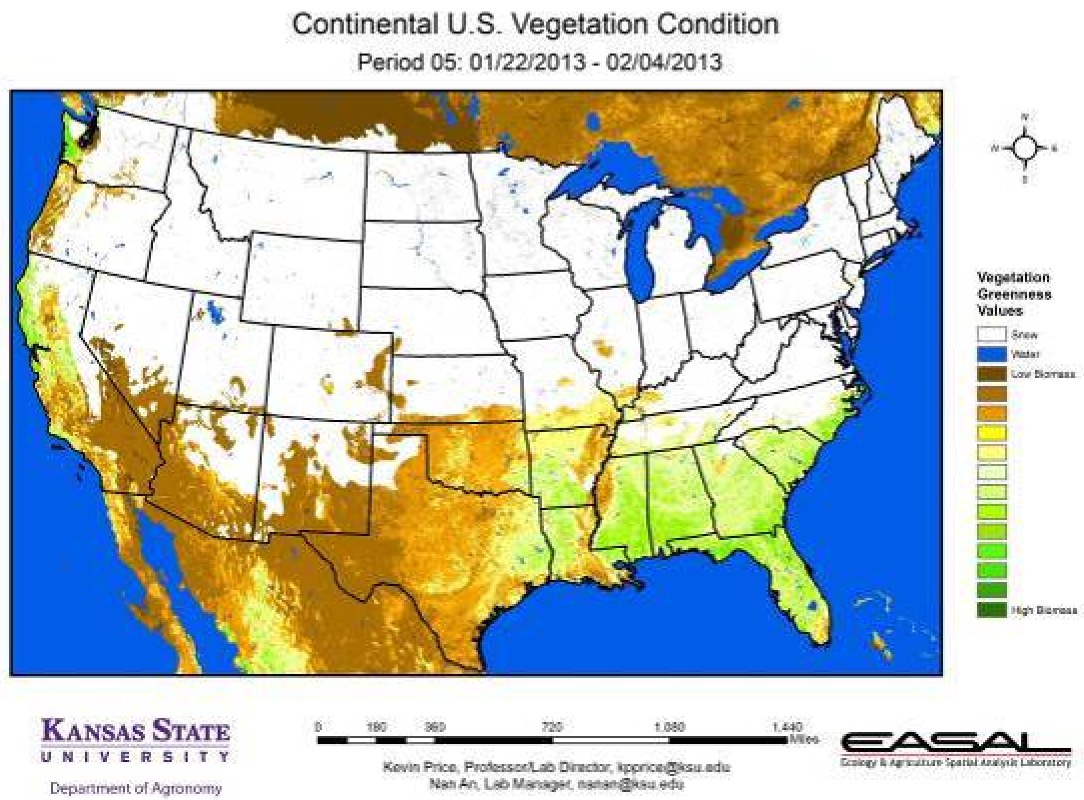
Map 4. The Vegetation Condition Report for the Corn Belt for January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that most of the region saw snow during the period. In the Upper Plains, 34 percent of the area has snow cover, with an average depth of 4.8 inches.



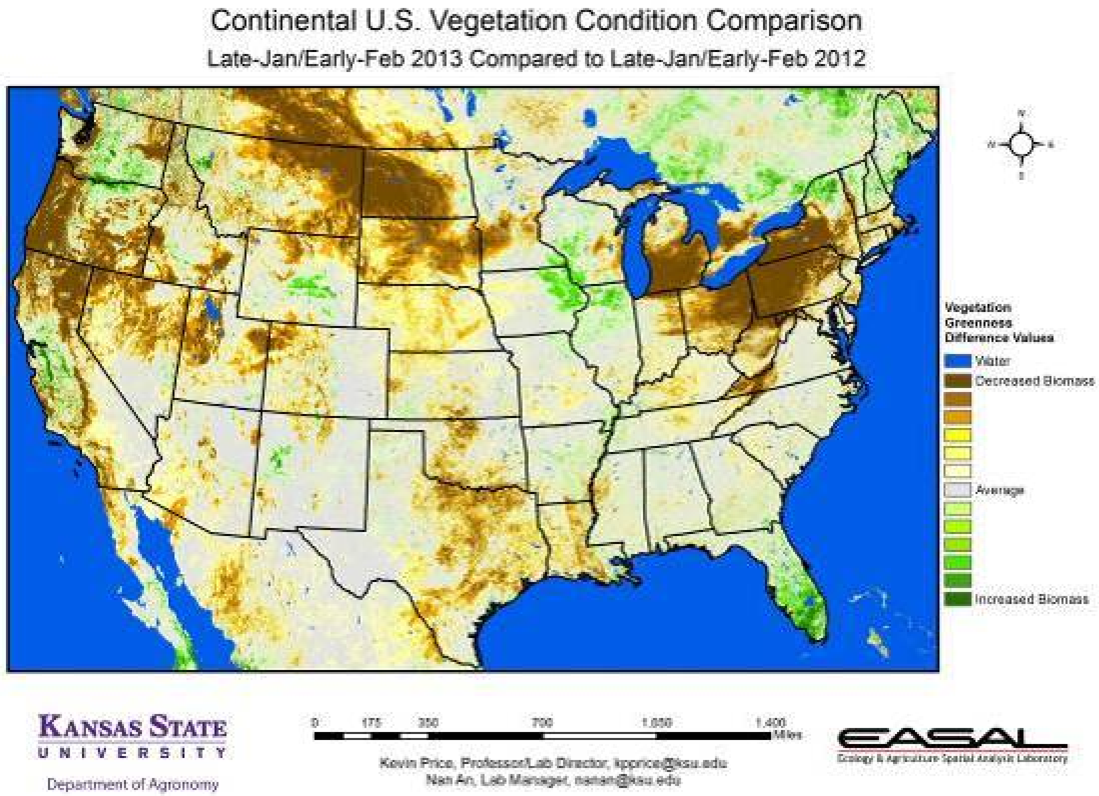
Map 5. The comparison to last year in the Corn Belt for the period January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows mostly lower photosynthetic activity across the region. The exception is in northeastern Iowa into northern Illinois, where a more favorable moisture pattern is in place this year.



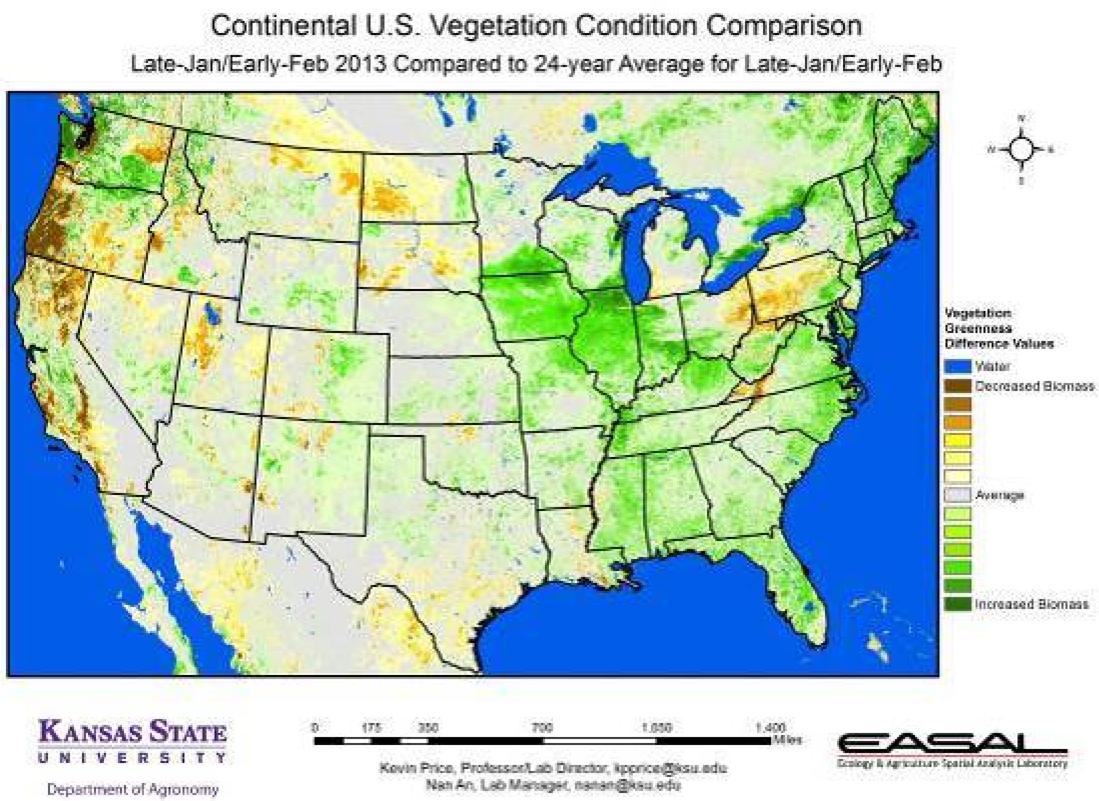
Map 6. Compared to the 24-year average at this time for the Corn Belt, this year's Vegetation Condition Report for January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that much of the central Corn Belt has above-average NDVI values. Moisture has been favorable and temperatures have averaged 6 to 10 degrees above normal. ...



Map 7. The Vegetation Condition Report for the U.S. for January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that again much of the country had snowfall. Only the southernmost areas escaped the winter weather pattern.



Map 8. The U.S. comparison to last year at this time for the period January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that photosynthetic activity is lower in most regions. In Texas, the lower precipitation values resulted in lower photosynthetic activity. Southern Florida, on the other hand, has seen more photosynthetic activity this year. Last year at this time, 46 percent of the state was in severe drought or worse. This year, less than 6 percent of the state has similar rankings of severe drought or worse.



Map 9. The U.S. comparison to the 24-year average for the period January 22 – February 4 from K-State's Ecology and Agriculture Spatial Analysis Laboratory shows that the eastern third of the lower 48 states has above-average photosynthetic activity. The area of greatest decrease in biomass production is along the Oregon Coast.

-- Mary Knapp, State Climatologist
mknapp@ksu.edu

-- Kevin Price, Agronomy and Geography, Remote Sensing, Natural Resources, GIS
kpprice@ksu.edu

-- Nan An, Graduate Research Assistant, Ecology & Agriculture Spatial Analysis Laboratory (EASAL)
nanan@ksu.edu

These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, Jim Shroyer, Crop Production Specialist 785-532-0397 jshroyer@ksu.edu, or Curtis Thompson, Extension Agronomy State Leader and Weed Management Specialist 785-532-3444 cthompso@ksu.edu.